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**THE EFFECT OF INCOME TAXES ON OPTIMAL
PORTFOLIO SELECTION**

by

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THE EFFECT OF INCOME TAXES ON OPTIMAL PORTFOLIO SELECTION

ABSTRACT

The ability to shelter both the periodic contribution and annual returns from income taxes in a qualified retirement plan provides well known advantages. However, given aggressive investing and a continuation of historic rates of return on financial assets, it is probable that both income during the retirement years and the effective tax rate will be higher than in the working years. Consequently, part of the additional expected return to taking greater risk is lost to taxes. This paper demonstrates that efficient (i.e., utility-maximizing) portfolio design must account for the potential for higher average and marginal income tax rates in retirement. Failure to fully consider the ultimate tax effects probably will result in a suboptimal portfolio of assets during both the accumulation and distribution phases. In general, failure to consider progressive taxes will result in portfolio being overinvested in the high-risk asset.

THE EFFECT OF INCOME TAXES ON OPTIMAL PORTFOLIO SELECTION

Introduction

The advantages of investing in tax-deferred retirement plans are well known. The ability to shelter both the periodic contribution and the annual returns from both state and local taxes provides a significant wealth-building advantage over nontax-deferred investments. However, given aggressive investing and a continuation of historic rates of return, it is possible that both income during the retirement years and the effective income tax rate will be higher than in the working years. Consequently, part of the additional expected return to taking greater risk is lost to taxes. This paper demonstrates that efficient (i.e., utility-maximizing) portfolio design must account for the potential of higher average and marginal income tax rates in retirement.

Tax Considerations for Investing in Qualified Plans

Here it is demonstrated that average and marginal tax rates easily could be higher during the retirement-withdrawal period than during the work-accumulation period, and that if these higher tax rates are not anticipated, the structure of the investment portfolio may not be efficient. This analysis is made in the context of a self-employed, high-income individual investing within the framework of defined contribution Keogh plan. Defined contribution Keogh plans limit annual contributions to the smaller of \$30,000 or 20% of self-employment income (after one-half of the self-employment tax is deducted). If a self-employed individual contributes the maximum of 20%, \$148,098 of self-employment earnings will generate a \$30,000 Keogh contribution. Assuming this investor is

married with several children and a home mortgage loan, it is likely that taxable income is below \$151,750, and, thus, the marginal federal income tax rate is 31%.

Consider a zero inflation world where the expected rate of return on some long-term, fixed-income investment (i.e., bonds) is 4% per year and the expected return on common stock (with commensurately greater risk) is 7%.¹ Further assume that real income remains constant and that the \$30,000 contribution is made each year. At age 65, the expected accumulation is \$4,147,106. At retirement the entire amount is switched to bonds and based on a single-life annuity to age 85, the expected retirement benefit is \$181,399 at age 60 and \$305,151 at age 65.²

By the age 65, the marginal tax rate on these payments probably will be at least 36% on the lower value and 39.6% on the higher payment. At this stage in life, the children are gone, the mortgage is paid off, the Keogh contribution is no longer being made; therefore, taxable income can be expected to be a higher proportion of total income than at age 30. Further, it is likely that other income-producing assets have been accumulated and that Social Security payments are being received; thus, total family income would be much greater than just the annual Keogh benefit. Thus, the 39.6% marginal tax rate may apply even to the case of retirement at age 60.

Estate taxes also must be considered. In the event of death, a surviving spouse can receive an unlimited estate free of taxes, but if the spouse is no longer living, the entire estate is subject to taxes ranging from 37% to 55% and includes all assets remaining in any tax-deferred plan, which

¹These are approximately the long-term annual rates of return of these assets. See Ibbotson Associates 1997.

²The retirement benefit is calculated on the annual payment forthcoming from a fund of the specified size invested at 4% per year to be exhausted at age 85.

also are subject to income tax upon their distribution. On an estate of over \$3,000,000, such as that in the example, the marginal tax rate is 55%.³

Thus, while saving and investing in qualified plans provides a significant tax shelter during the working years, it is clear that average and marginal income tax rates during the retirement period can easily be higher than during the working period. The “conventional wisdom” that retirement income will be taxed at lower rates than working income simply is not true for the high income person who invests aggressively in a tax-deferred plan. If the higher tax rate is not anticipated, the expectation of aftertax retirement income will be overestimated, and, most important, the individual probably will not have invested in an efficient portfolio.

Investment Strategy

The expected after-tax retirement income for a higher risk portfolio will always be higher than that of the lower risk portfolio. However, the investor should be aware that if higher average and marginal tax rates apply, a part of the return for taking additional risk is lost to the tax. The effect is demonstrated in the following formalized example.

Consider the case as above where an individual makes an annual contribution (C) of \$30,000 each year for $T = 35$ years to a tax-deferred plan where there are two investment vehicles—a low-risk asset, A , with an expected annual return of $r_A = 0.04$ (i.e., the base case), and a high risk asset, B ,

³Prior to the 1997 tax law changes, there was a tax penalty on excess accumulations in qualified plans upon the death of the owner. Specifically, for 1997, a 15% excise tax (above any other estate taxes that would be due) was imposed on amounts that exceeded the present value of a hypothetical life annuity of \$160,000. Further, no credits or exclusions that would otherwise reduce or eliminate the ordinary estate tax were allowed. The excise tax on a \$4 million accumulation depended on the current interest rate on Treasury securities; in 1997, this excise tax would have been about \$412,000.

with an expected return of $r_B = 0.07$. (See Table 1.) At the end of the accumulation period, the expected fund invested in asset A is

$$F_A = C \left[\frac{(1 + r_A)^T - 1}{r_A} \right] = 30,000 \left[\frac{(1 + 0.04)^{35} - 1}{0.04} \right] = 2,209,567.$$

This will generate an expected annual income of \$162,584 during an $N = 20$ year distribution period, i.e.,

$$Y_A = \frac{F_A}{PVAF(N, r_A)} = \frac{\$2,209,567}{PVAF(20, 0.04)} = \$162,584,$$

where $PVAF(N, r_A)$ is the present value annuity factor. For simplicity, assume this represents the totality of taxable income for the family. The ordinary income tax on this amount based on the 1997 rate schedule is \$37,779 (assuming the standard deduction and two personal exemptions), leaving a net aftertax income of \$124,805. The average tax rate is 23.23% in this case.

Had the funds been invested in the high-risk asset, the expected fund value at the end of 35 years is $F_B = \$4,147,106$. With maintaining the funds in the high-risk asset, the expected annual withdrawal is $Y_B = \$391,457$ (or higher than the base case by a factor of 2.41). This retirement income is subject to ordinary income tax of \$125,962, leaving an aftertax income of \$265,495, which is higher than that generated in the low-risk alternative by a factor of 2.13. Thus, taking additional risk through both the accumulation and distribution periods added 141% to pretax income but only 113% to aftertax income. (See Table 1.)

In the intermediate case, the funds are invested in the high-risk asset during the accumulation phase and then shifted to the lower risk bond portfolios during the distribution phase. Here the \$4.1

Table 1. Fund Balance, Annual Benefit, and Tax Effects of Alternative Investment Strategies

	Alternatives		
	A (Base)	B	C
Investment during accumulation period	Low risk	High risk	High risk
—Rate of return	4.0%	7.0%	7.0%
Investment during distribution period	Low risk	High risk	Low risk
—Rate of return	4.0%	7.0%	4.0%
Expectation of:			
—Fund at end of accumulation period	\$2,209,567	\$4,147,106	\$4,147,106
—Annual pretax payout during distribution period	162,584	391,457	305,151
—Annual posttax payment during distribution period	124,805	265,495	204,866
—Average tax rate	23.2%	32.2%	30.1%
—Marginal tax rate	31.0%	39.6%	39.6%
Ratio of:			
—Fund to base case fund	1.00	1.88	1.88
—Pretax payment during distribution period	1.00	2.41	1.88
—Posttax payment during distribution period	1.00	2.13	1.64

million fund at retirement generates an annual retirement payment of \$305,151, or 88% more than under the first alternative. Aftertax income is \$204,866 per year. The relevant data for each of the three cases considered are reported in Table 1.

If the individual's objective is maximization of expected after-tax retirement income, then all retirement funds should be invested in the high-risk asset. However, in the more general case, the objective is utility maximization with its explicit consideration of the trade-off between risk and return, and this may dictate a different mix of assets. Specifically, if marginal tax rates are progressive, part of the additional expected return to taking greater risk is lost to the tax. For many

investors it can be shown that the efficient portfolio should be structured to involve less risk than if the higher tax rates tax did not apply.

This analysis is depicted in Figure 1, where expected return ($E(Y)$) is shown on the vertical axis, and risk (σ) is measured on the horizontal axis. The straight line $CML(E(Y))$ is the *capital market line* or CML, showing the linear relationship between portfolio risk and return. (See Copeland and Weston 1988, chapter 6.) Line $E(Y - T_f)$ shows the expected return after ordinary income tax (T_f) and is nonlinear to reflect the progressive nature of the income tax system.

Consider a very risk-averse investor for whom two indifference curves, I_1 and I_2 , are shown. This person only invests in the risk-free asset (e.g., Treasury bills) and generates a relatively small

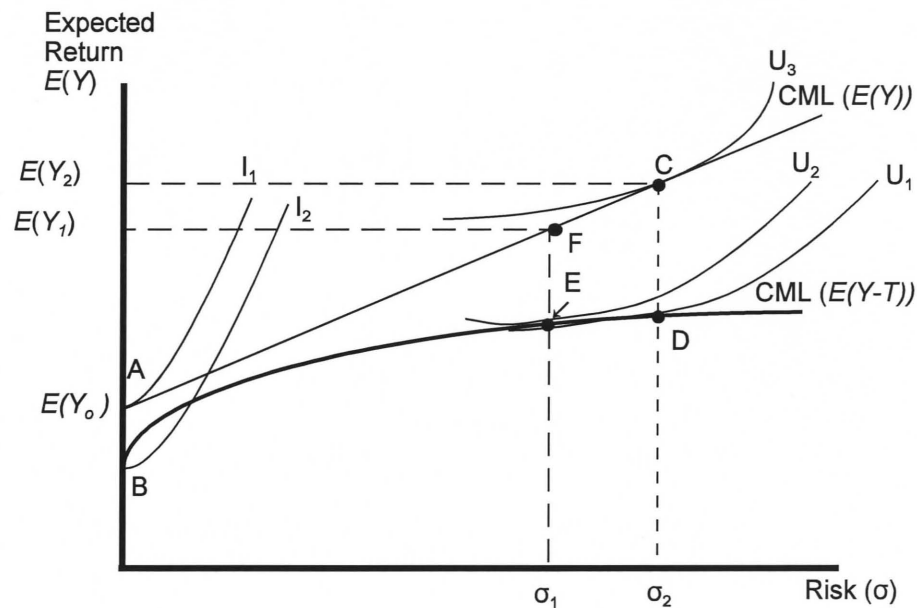


Figure 1. The Effect of Income and Excise Taxes on Optimal Portfolio

fund and retirement income ($E(Y_0)$ at point A). Here the effect of taxes would not be a significant factor in the optimal portfolio.⁴

The analysis is more interesting for the less risk-averse person whose indifference mapping is depicted by curves U_1 , U_2 , and U_3 . Assume this individual's objective is utility maximization and that he is naive about the potential tax effects on retirement income (especially the reality that average and marginal tax rates will be higher in the distribution phase). He chooses to take risk, σ_2 , and expected pretax income, $E(Y_2)$, which would put him on indifference curve U_3 (i.e., at point C). But the effect of the ordinary income tax actually puts him at point D on U_1 . For this person, a higher level of utility (U_2) could be achieved by a less risky portfolio (i.e., a mix of assets A and B) that, on an aftertax basis, would put him at point E on U_2 . Pretax, the optimal risk-return combination is $\sigma_1, E(y_1)$.

Summary

There is no question that investing for retirement in a qualified plan is a powerful wealth-building technique. The ability to shelter both current income and annual returns from both state and federal income taxes greatly increases the value of funds so invested over the use of aftertax income in nonsheltered accounts. High-income persons who invest in higher risk assets can expect to accumulate very large balances; indeed, for the aggressive investor, it would not be unusual for pretax retirement income to exceed working income at the normal retirement age.

⁴For example, using the same factors as before, except that a real rate of return of 2% is assumed for a Treasury bill investment, the fund would be \$1,499,834 at the end of the 35-year accumulation period; this would generate an annual pretax and posttax income of \$91,724 and \$71,397, respectively.

However, all of the assets in a qualified plan ultimately will be subject to income taxes and, in many cases, estate taxes as well. These taxes are significantly progressive, and, effectively, they reduce the return to risk taking. Failure to consider their ultimate effects probably will result in a suboptimal portfolio of assets during both the accumulation and distribution phases. In general, failure to consider these progressive taxes will result in the portfolio being overinvested in the high-risk asset.

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